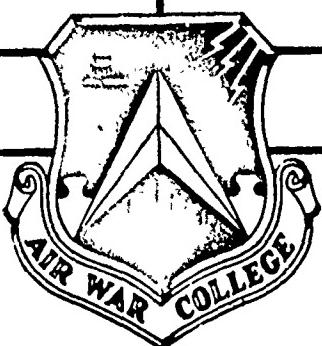


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RESEARCH REPORT



AD-A217 478

DR TO GPS AEROSPACE FLIGHT OFFICER (AFO)

LIEUTENANT COLONEL JAMES B. WATT

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AIR UNIVERSITY
UNITED STATES AIR FORCE
MAXWELL AIR FORCE BASE, ALABAMA

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DR TO GPS

AEROSPACE FLIGHT OFFICER

(AFO)

by

James B. Watt
Lieutenant Colonel, USAF

A DEFENSE ANALYTICAL STUDY SUBMITTED TO THE FACULTY

IN

FULFILLMENT OF THE CURRICULUM

REQUIREMENT

ADVISOR: Lieutenant Colonel James H. Smith

MAXWELL AIR FORCE BASE, ALABAMA

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EXECUTIVE SUMMARY

TITLE: DR To GPS, Aerospace Flight Officer (AFO)

AUTHOR: James B. Watt, Lieutenant Colonel, USAF

An evolutionary retrospection reveals the United States Air Force (USAF) Navigator (known by over 20 duty titles) does not enjoy a homogeneous tradition as a navigator. Further, it reveals training programs which prepared and presently prepare dissimilar aircrew specialists who are not "universally assignable" navigators. Present duty requirements in 15 weapon systems and all 8 navigation Air Force specialty career fields were analyzed. The results indicated navigator as an umbrella duty title and aeronautical rating is "inaccurate, misleading, exclusive, inflexible, outdated...". A new umbrella duty title and aeronautical rating is needed for the present and the future. One is recommended which would provide the USAF and the aircrew specialist more flexibility, more accuracy and more room to accommodate future specialization... Aerospace Flight Office (AFO)."

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BIOGRAPHICAL SKETCH

Lieutenant Colonel James B. Watt, a native Californian, is a 1969 graduate of San Diego State University. Earning bachelor degrees in political science and history, he specialized in Southeast Asian studies. He earned his Master of Business Administration Degree in 1973 from Golden Gate University. Colonel Watt has completed all Air Force service schools.

Colonel Watt has had a varied career. In 1969 he earned his commission as an AFROTC distinguished graduate. After completing the Aircraft Maintenance Officer Course as a distinguished graduate, he was assigned to Air Force Logistics Command at McClellan AFB. While at McClellan AFB, he completed the undergraduate industrial engineering curriculum from the University of California and worked as a Numbered Air Force Project Engineer on the FB-111. During this assignment he initiated the first "life-cycle costing" project in the Air Force for which he received a Presidential Citation. After completing Undergraduate Navigator Training in 1973, he served in Southeast Asia in the C-130. Upon return to the US, he became an instructor navigator at Undergraduate Navigator Training, Mather AFB. In 1976, he was selected the Air Training Command Instructor of the Year and in 1977 he was selected the national Air Force Association Navigator/Instructor of the Year. From 1979 to 1983, Colonel Watt served as wing

executive officer, squadron commander and chief of the standardization and evaluation division at the Basic Military Training School, Lackland AFB. Upon graduation from Air Command and Staff College as a distinguished graduate in 1984, he was assigned to Headquarters Air Training Command, Randolph AFB. While at HQ ATC he served as the Chief of Navigator Training and primary architect of Specialized Undergraduate Navigator Training (SUNT). He then helped implement SUNT as the 451st Flying Training Squadron Commander and 323rd Flying Training Wing Assistant Deputy Commander for Operations before attending Air War College 1988-89.

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CHAPTER I

INTRODUCTION

"Navigation is defined as the process of directing the movement of craft from one place to another." A "Navigator," therefore is an individual who directs a craft from one place to another. Some unique characteristics or factors which differentiate an aerial navigator from all other navigators are "continuous movement of the craft being navigated, limited airborne endurance, relative speed of craft which reduces decision time and the dimension of weather which contributes significant obstacles to navigation." Moreover, "navigation is considered both an art and a science." One must consider the "art" of skillful interpretation of available data which emerges from experience and practice resulting in "air sense and nav (navigator) judgement." One must also consider the "science of mathematical determination and computation of data inputs which has supported the development of the "black boxes" of technology (i.e., inertial navigation systems, etc.). This, henceforth, will serve as the "classical" definition of "Navigator" in this study. (3:1)

Problem Statement

The "classical" duties of the United States Air Force (USAF) Navigator have diminished. A new aircrew member has emerged known by many different names which reflect specific duties: Offensive Systems Officer (OSO), Defensive Systems Officer (DSO), Reconnaissance Systems Officer (RSO), Electronic Warfare Officer (EWO), Weapon Systems Officer (WSO), etc. All of these aircrew specialists come under the "umbrella" and hold the aeronautical rating of USAF Navigator. Thus the connotation to those unfamiliar with flying is that a navigator is someone who performs the "classical" duties of

aerial navigation. Are the interests of the USAF and these aircrew specialists best served by this traditional "umbrella?" Would a new aeronautical rating provide a more accurate, more inclusive, more flexible, more forward-looking "umbrella" for the aircrew specialists of the USAF?

Objectives

In the attempt to address the stated problem, the author sought to accomplish five objectives. First, to examine the evolution of the USAF Navigator from conception to present. Second, to examine the chronological development of training USAF Navigators to meet duty requirements. Third, to analyze present duty requirements of aircrew specialists in present inventory weapon systems. Fourth, to forecast future duty requirements in light of developing systems and technology. Fifth, to draw conclusions and make recommendations on whether to supplant the nautical rating of "Navigator" based on the history, accuracy, inclusiveness, flexibility and future requirements of this duty title.

Project Plan

A separate chapter is devoted to each objective. Chapter II examines the chronological evolution of the USAF Navigator from the "aviation officer" of pre-World War I to present. This chapter is structured as follows:

1. Prior to World War II
2. During World War II

3. Post World War II

Chapter III examines the chronological development of training USAF Navigators to meet the duty requirements of the day. This chapter also identifies three distinct periods and approaches to training:

1. Pan American contract training to Undergraduate Navigator Training (UNT)
2. UNT
3. Specialized Undergraduate Navigator Training (SUNT)

Chapter IV analyzes present duty requirements in 15 weapon systems through expert testimony of fully-qualified, experienced aircrew specialists. Chapter V presents future duty requirements of aircrew specialists based on unclassified, publicly acknowledged avionics and weapon systems. Chapter VI offers conclusions and recommendations.

Assumptions and Limitations

The scope of this study focuses on the predetermined requirements of USAF aircrew specialists. The necessity and future of these requirements stand beyond the scope of this study. Additionally, comparative analyses of career progression, opportunities, promotions, retention, etc. also stand beyond the scope of this study.

CHAPTER II

EVOLUTION OF THE USAF NAVIGATOR

"Navigation is a hybrid, applied science that uses a variety of instruments and techniques to determine three things: the present position of a vehicle, the direction to steer to reach a desired position, and the estimated time of arrival at that desired position." (49:3)

This chapter examines the chronological evolution of the USAF Navigator from the "aviation officer" of pre World War I to present.

Prior to World War II

About six years after the Wright brothers' first flight at Kitty Hawk, the first automobile cross-country trip from San Francisco to New York and the signing of the Panama Canal Treaty in 1903, the world of aviation reached a significant plateau. (24:447) Airplanes were flying longer distances and some means of aerial navigation was required. Two solutions came forth: put a second aircrew member on board who would concentrate on aerial navigation or paint signs on the ground on buildings, hangars, barns, etc. to aid the pilot. The pilots preferred signs on the ground, as a second aircrew member added weight and required crew coordination. This would result in decreasing range and flight performance; however, ground signs would require pilots to possess excellent vision. Signs were chosen. (49:55-58)

Signs, however, were not the universal choice. The Germans chose, "Beobachters," observers as integral aircrew members. The English chose "observers," and the French used "navigateurs." By 1910 the Americans had decided an aircrew member specializing in navigation was required. On 15 October 1910 the first North Atlantic flight was attempted from Atlantic City bound for Europe. One of the aircrew members on board was a navigator. This flight ended after 375 nautical miles due to engine failure. (49: 60-63)

From 1910 until World War I the aviation enthusiasts concentrated on building aircraft with improved performance, range and reliability. Navigation and flight instruments received little attention. Flights were conducted over familiar terrain in good weather. Then World War I came onto the horizon.

The missions of the airplane were limited in World War I due to strategy, tactics, aircraft performance, communication and lack of a capability to navigate in a hostile environment of enemy forces and bad weather. However, the British and French recognized a limited aircraft bombing role. On these bombing missions they used "lead navigators" to direct bombing strikes. The duties of these aircrew specialists were considered among the most difficult and were essential to mission success. (49:99)

In America military aviation was just beginning to grow. In 1910 Lt Benny Foulois was the United States Army's only pilot. In late 1909, Brigadier General James Allen, Chief Signal Officer had given Lt Foulois the following direction, "Your orders are simple, Lieutenant. You are to evaluate the airplane. Just take plenty of spare parts and teach yourself to fly." Lt Foulois accomplished his mission by 1910. Seven years later in April 1917 when America entered World War I the U. S. Army had 100 pilots but no combat aircraft. By the end of World War I, the U.S. Army had over 10,000 "aviation officers." (17:2-13) How many of these officers were pilots, navigators or observers is not possible to know since the only distinction in the U.S. Army prior to 1920 was "aviation officers and non-aviation officers or ground combat officers." The National Defense Act of 1920 (Public Law 66-242, 4 June 1920) only made the distinction of "flying officers." This law organizationally placed Air Service under the Signal Corps. Not until 1926 was further distinction made. On 2 June 1926 House Resolution 10827 became Public Law 69-446 and created the U.S. Army Air Corps. This law also made the distinction between pilots and observers with regards to ratings and command opportunities. This action followed the U.S. Navy's recognition of the Naval Aviation Observer (NAO) in 1922

was in 1964 redesignated Naval Flight Officer (NFO). (31:8-15)

In the civilian sector of aviation in 1919, the International Air Navigation Convention (IANC) required all public transport flights carrying more than 10 passengers a distance of 272 nautical miles over land or 108 nautical miles over water or at night to have a "navigator" on board. The IANC later changed its name to International Civil Aviation Organization (ICAO). The U.S. civilian sector did not comply with this regulation until 1926 when domestic regulations first recognized the aircrew specialist position of "navigator." To this point pilots were taught basic dead reckoning navigation. (49:114-115)

The ability to use dead reckoning navigation techniques proved sufficient for over-land flights when known and visible cultural (towns, roads, railroads, etc.) and terrain (mountains, lakes, rivers, etc.) returns provided accurate position updates. However, over water for long distances posed a new, more difficult challenge. This challenge stood at the top of Charles Lindbergh's accomplishments in 1927 after his initial flight from New York to Paris. Lindbergh credited his skill in celestial navigation as his reason for success. This gave a great boost to the significance of aerial navigation as a learned skill and the need for accurate navigational equipment. The Army Air Corps recognized this significance and

assigned several pilots to investigate the feasibility of training aircrew members as specialists in the art and science of aerial navigation. They decided against the concept. However, pilots did receive additional training in aerial navigation. (32:1-2)

This proved to be a temporary solution by the middle 1930s when the B-17s and B-18s roared onto the military airfields. These aircraft represented the state of the art in bomber aircraft. The B-17, Flying Fortress, became a primary aircraft, weapon system. It was subsequently equipped with the Norden bombsight which required skilled specialists, "bombardiers and navigators," to accurately and effectively accomplish its mission.

(29:1) In 1935 the B-17 could fly faster and farther than any pursuit (fighter) aircraft. With its Norden bombsight, the B-17 proved effective for high-level, deep, daylight bombing which supported the doctrinal mainstay of the Army Air Corps according to the late General Haywood Hansell.

(20) By 1939 the Army Air Corps was espousing the effectiveness of night bombing and exalting the roles of the bombardier and navigator. The concept of a pilot following the directions of a navigator to a target and then being told to "hold the wings steady" by a bombardier who fine tuned the target approach and dropped the bombs was heresy. The predominate thinking among the pilots was that a pilot should be able to perform all required duties.

If one pilot proved insufficient a second or third pilot should be added. In fact, "in 1938 a B-18 aircraft commander had to be qualified as a B-18 pilot, celestial navigator, expert bomber, and expert aerial gunner." It did not take long to recognize the futility of this. By July 1938 the Army Air Corps requested the training of aircrew members as navigator-bombardiers who were not rated pilots. (49:181-185) This recognition set the scene for the World War II aircrew specialists.

Spot Summary

From the beginning to prior to World War II the aircrew specialist (navigator, bombardier and observer) traveled a rocky road of acceptance and faced an uncertain future. The flying community of the military pilot reflected significant reluctance to recognize the need for the aircrew specialists and supported several roadblocks to the development of such a requirement. However, logic prevailed as the need became clear as World War II approached.

World War II

Among the forward thinkers of the Army Air Corps who saw the need for aircrew specialists were Lts Curtis LeMay and Thomas Thurlow. They championed the need for bombardiers and navigators in bomber aircraft and supported the development of specialized training. Lt LeMay enrolled in the first navigation class at Langley Field to lend his

support and to understand the requirements of these aircrew specialties. (49:187-199)

By 1939 due to bomber aircraft requirements, aerial navigation specialists had become essential. According to the Chief of Plans, Army Air Corps, 166 aircrew members had qualified as aerial navigation specialists in 1939 and the requirement stood at 506. This requirement grew to 1,800 by 1940. By 1943 the annual production of 20,000 observers-navigators-bombardiers became the requirement. This requirement explosion created severe shortages and became the lynch pin of the United States Army Air Forces (USAAF). Aircrew specialists received abbreviated training, under makeshift conditions from undermanned and inexperienced training staffs. The bombers received top priority on these minimally trained observers-navigators-bombardiers while the Air Transport Command, Troop Carrier Command and Anti-submarine Command were manned as low as 33 percent of authorized strength. Given this critical challenge, these new aircrew members accomplished their training with minimal resources in minimum time. (32:3-5, 16)

The first all-American bomber mission of World War II in Europe occurred on 17 August 1942. An armada of 18 B-17s struck the western, Nazi occupied, coast of France and significantly damaged an important railroad marshalling

yard. Brigadier General Ira Eaker led the raid and a dozen bombardiers put the bombs on the targets. (23:33-4)

On the B-17, Flying Fortress, the pilot, aircraft commander, directed the aircrrew except when the bombardier took command over the target and dropped the bombs. Upon bomb release the aircraft commander again assumed command of the aircraft. The emphasis, however, was on teamwork and crew discipline. Each crew member performed essential duties. The pilots flew the aircraft maintaining their position in formation, the navigator directed the aircraft to arrive on time on target, and the bombardier dropped the bombs on the target. The remaining five to seven aircrrew specialists (gunners, radio and flight engineers) also performed their essential duties of defending the aircraft, ensuring communications and air worthiness. (9:16-17)

The formation lead-navigator carried the responsibility of directing the entire formation to the target within given time restrictions. Given the available aids to navigation, marginal weather conditions, and enemy aircraft and anti-air artillery, this was a formidable task. The formation lead-bombardier carried an equally heavy responsibility as trailing bombardiers used various techniques of dropping their bombs off the lead-bombardier's bombs.

The fates of the aircrrews depended on the accuracy of the bombardier. In the "thirty seconds" when the

bombardier took command over the target, he assumed "one of the toughest and most exacting jobs in the air service." The bombardiers worked under tremendous combat pressure. They knew, as did the rest of the crew, any small error would result in wasted bombs and would likely require the scheduling of another mission. Under these conditions the bombardier's performance was elevated to top priority.

(28:41, 74-5)

General Eaker lauded his inexperienced bombardiers and boasted, "Forty percent of the bomb loads dropped....would fall within 500 yards of the aiming point." (23:37) This was a considerable feat given the inexperience of the young crews who dropped their bombs from 22,000 feet in marginal weather infested with enemy aircraft and flak.

The B-17s and B-24s (Liberators) demonstrated improved accuracy and combat crew teamwork, but the major challenge was yet to come. In 1942, the reorganized United States Army Air Forces (USAAF) initiated the Combined Bomber Offensive. This campaign required unescorted, daylight bombing missions deep into the enemy's homeland. The intelligence briefers described the targets and the enemy defenses to be expected, and the aircrues recognized their vulnerability. On the first three missions, two over Schweinfurt and one over Regensburg, 120 B-17s were lost, and at the end of the fourteenth week in the Fall of 1943,

357 bombers had been lost. The surviving crews had become combat hardened and experienced but the price was unacceptable. (23:49-54)

By the beginning of 1944, improved fighter aircraft could provide escort on deep missions into Germany. With renewed confidence the "Big Week" campaign commenced on 19 February 1944. During "Big Week" 3,300 bomber sorties were flown and 10,000 tons of bombs hit an estimated 75 percent of the planned targets. The bombardiers benefitted from a more stable bombing platform due to fighter coverage and less maneuvering for defensive reasons. As the aircraft became more capable and the aircrews more experienced the effectiveness of the B-17 proved more lethal. For example, the bomber strikes against Nazi oil refineries had all but grounded the Luftwaffe by the summer of 1944. (23:54-69)

Although many divergent accounts of the strategic bombing effectiveness in Europe have been put forth, perhaps the most telling are those of the Nazi leadership. The Luftwaffe Commander, Herman Goering, stated, "...precision bombing had been more effective than area bombing...the size, skill, and methods of the AAF and RAF had ruined the German nation." Field Marshall Karl von Rundstedt supported Goering's assertion stating, "Air power was the most important weapon used by the Allies." Albert Speer, Minister of Armaments Production, echoed the above but was more precise, "...strategic bombing alone could

have won the war." (23:73) Many historians and strategists have disputed the above testimony of those who endured strategic bombing, but the impact on Hitler's Empire by strategic bombing was clearly devastating.

In examining the chronological evolution of the aircrew specialist during World War II in Europe, one must recognize the aircrew specialist had evolved from a "non-person" to a recognized essential aircrew member by several duty titles: observer, navigator and bombardier. Each of these aircrew specialists performed specific and unique duties, and they performed them heroically as was also true in the Pacific Theater.

From the morale boosting "Doolittle Raid" on 18 April 1942 of 16 B-25s, through the B-17 navigators' and bombardiers' "graduation flights" during the Battle of Midway, to the B-24 and B-25 attacks on New Guinea and the return to the Philippines, to the first B-29 (Superfortress) mission against Japan's homeland on 15 June 1944, to the B-29 night fire bombing of Tokyo in which over 220,000 Japanese were killed or wounded, the aircrew specialists, navigators and bombardiers, performed their unique and essential duties efficiently and professionally. But not until 6 August 1945 did any of these team players receive worldwide recognition. (23:123-57)

Then on 6 August 1945, the B-29 Enola Gay piloted by Lt Col Paul Tibbets arrived over Hiroshima, Japan.

Bombardier, Major Thomas Ferebee assumed command of the aircraft and dropped the first atomic bomb. A second, more powerful atomic bomb was dropped by bombardier, Captain Kermit Beahan three days later on Nagasaki. These two bombs accounted for the deaths of approximately 125,000 Japanese. They also accounted for the surrender of Japan on 10 August 1945. The B-29 with its fire bombs and atomic bombs had defeated the Japanese and ended World War II.

(23:160-166)

One testimonial summarizes the role of airpower in the Pacific. Fleet Admiral Osami Nagano, Supreme Naval Adviser to the Emperor of Japan:

"In modern war, control of the air is of primary importance. A well-proportioned army and navy is essential, but the importance of an army and a navy has been greatly reduced as the result of air development. If I were to name but one factor leading to your victory, I would give you the air force." (23:167)

Spot Summary

From the visions of Lts Curtis LeMay and Thomas Thurlow to the first atomic bomb, navigators, observers, and bombardiers played essential roles in WWII. In 1939, the Army Air Corps listed 166 aerial navigation specialists on its personnel records, but by 1943 the USAAF was training 20,000 annually. The first use of these aircrew specialists occurred on B-17 missions over France in August 1942. It was during these missions that the essentiality of the formation lead-navigator and lead-bombardier was

established. These aircrew specialists helped change the course of WWII and history through daylight precision bombing. From Schweinfurt, to "Big Week - 1944," to the fire bombing of Tokyo, bombs on target meant success. The final two bombs on target ended WWII.

Japanese Admiral Nagano credited the air development of the strategic bomber and its integrated aircrew as the preeminent factors of allied victory. The new members of the aircrew concept were navigators and bombardiers. These new aircrew members had evolved to a point of recognized essentiality. The bomber aircraft which followed World War II would include these and other aircrew specialists, but the country's mind focused on peace and demobilization.

Post World War II

Demobilization emerged as the logical and popular by-product of the successful conclusion of World War II. A documented frenzy of America getting back to prewar military status was slowed by the emergence of another strong adversary, the Soviet Union. However, in 1945 at war's end the AAF listed over 50,000 officers as navigators (meaning navigators, observers and bombardiers) and by 1946 this number had dwindled to 1900. (21:2) Additionally, between 1947 and 1950, 694 aerial observers, navigators and bombardiers were trained or about 175 per year. This compared to a high of 20,088 trained in 1945. (44:14) The

aircrew specialist had practically disappeared as emphasis was being placed on single-seat, jet fighter aircraft. Then the Korean peninsula erupted in war.

The Korean War was a limited war with specific restrictions and limited objectives. Few strategic targets existed in Korea and Red Chinese strategic targets were off limits. However, during the conflict United States Air Force (USAF) aerial observers, navigators and bombardiers participated in 21,329 B-29 combat sorties. These sorties took three months to fly with the results that "every strategic industrial target in North Korea" was destroyed. Further use of the B-29 was restricted by national policy.

(25:5)

In the interim between World War II and Korea the Strategic Air Command (SAC) had been founded. From its inception in 1946, SAC supported the manned bomber weapon system and the combat crew concept. Navigators and bombardiers remained essential to SAC's mission. SAC continued to modernize replacing the B-29 with the B-47 and the B-47 with the B-52 and FB-111. Not until the Vietnam war of the 1960s and early 1970s did the SAC combat crews of the B-52 and FB-111 participate in war. By 1970 General B. K. Holloway reaffirmed the essentiality of the aircrew specialists by asserting "...our bomber, tanker and reconnaissance navigators are the focal point of their respective aircrew missions." (25:ii) Of course, when

General Holloway said "navigator" he included KC-135 and B-52 navigators, B-52 radar navigators (bombardiers), B-52 electronic warfare officers (EWOs), FB-111 radar navigators, and SR-71 reconnaissance systems officers (RSO's) under the same umbrella. However, all these aircrew specialists performed uniquely different duties with uniquely different equipment.

Vietnam also served as a proving ground for B-52 radar navigators (bombardiers) and allowed them to demonstrate the conventional capabilities of the B-52 which had been designed and deployed as a strategic nuclear bomber. Every B-52 combat crew was judged on the proficiency of putting bombs on the target. As in World War II, this brought the intense focus directly on the skill of the B-52 radar navigator (bombardier). He again demonstrated professional competence and made a difference.

(26:9) Vietnam also served as a proving ground for the USAF's frontline fighter, the F-4.

Not until the F-4 in the early 1960s did an Air Force fighter aircraft require a second aircrew member. However, due to aircraft capability and increased avionics sophistication, a second seater was needed to share the workload. In Vietnam the F-4 and reconnaissance version, RF-4, became frontline weapon systems. Initially, the second seater or back seater was an inexperienced fighter pilot serving an apprenticeship of sorts. The backseater

carried the duty title of GIB (guy in back). This distinction created morale problems as the GIB's goal was to become a front seater fighter pilot. This problem coupled with a shortage of pilots and long training program led to a test known as "Combat Team." (48:1)

In 1967, "Combat Team" was conducted under combat conditions in Vietnam with 12 navigators designated weapon systems officers (WSO) to determine if they could handle the duties of a back seater. The WSOs proved to be equally as competent as the GIBs with higher morale and improved crew coordination. The end result showed the F-4 with a WSO in the back was an improved weapon system. (48:2) Additionally, the WSO in the F-4 relieved the shortage of pilots and saved the Air Force about \$400 million in training costs over 5 years. This experience also paved the way for a navigator second seater in the F-111 and FB-111. (34:9) The Air Force created a new four digit Air Force Specialty Code (AFSC) to recognize the unique skills of a WSO. Effective 31 July 1969, the Weapon Systems Officer (WSO) became a 1555 by AFSC and a Navigator-WSO by duty title. (48:1) The gates of change had swung open. No longer would a navigator be just a navigator.

By 1970, 15,304 aircrew specialists still officially under the duty-title umbrella of "navigator" were serving in nine different types of aircraft. (34:21)

Many predicted the zenith of the navigator career field had been reached.

In addition to increases in numbers and specialty codes, Vietnam had fueled the development of more sophisticated avionics and aids to navigation. These "black boxes" could perform several functions previously accomplished by the navigator. The advent of the inertial navigation systems (INS) led many to predict the demise of the navigator career field. In 1972, Lt Col Jim Paschall stated, "technology has made the field of navigation obsolete." (34:11) In 1977 the USAF Rated Management Board predicted the replacement of officer navigators by enlisted Flight Systems Officers (FSOs) on several aircraft.

(12:17) In 1978 Major Francis Casey wrote "Navigation: Death of a Profession" as an Air Command and Staff College student. In his study he predicted a "significant decline in the next five years" and suggested the demise could take ten years. (12:1)

The demise of the navigator career field became a popular prediction in the late 1970's and early 1980's. By 1984, however, approximately 10,300 navigators were still serving in the Air Force (19) Their future did, however, look bleak as navigators were removed from the C-5 weapon system and reduced to 118 on the C-141. They were replaced by "black boxes." Additionally, the new aircraft in the inventory F-16, F-15 and KC-10 did not require navigators.

This bleak outlook reflected an unintentional miscommunication. While the "classic, traditional" duties of a navigator of the "science" side were being supplanted by "black boxes"; the "art" side demanded a continued requirement for aircrew specialists.

Recalling the lessons of "Combat Team" in the mid 1960's a "navigator is no longer a navigator." Today's AFR 36-1, Officer Classification, reflects this by listing 9 separate Air Force Specialty Codes (AFSC's) in 12 different basic aircraft (i.e. an F-4 and RF-4 counted as one basic aircraft). Additionally, over 9,500 15XXs (AFSC for navigator career field) are still serving in the Air Force, and the new aircraft in the inventory, B-1 and F-15E, require 15XXs.

Spot Summary

Post World War II, the navigator career field has seen many changes, the number of navigators in uniform hit a high of 50,000 in 1945 and a low of 1900 in 1946. Since the Korean War the numbers have diminished, but the diversity of duties have increased. The navigator no longer performs only the classic duties of directing an aircraft from point A to point B. The navigator known by numerous duty titles and AFSCs performs uniquely essential duties on several different aircraft. In fact several predictions of the navigator career field demise have proved wrong, as new opportunities become available.

This chronological evolution of the Air Force Navigator tells only half the story. The other half is the training that evolved to produce these results. In Chapter III, the author will examine the training process evolution.

CHAPTER III

NAVIGATOR TRAINING PROGRAMS

Early

(1928 - 1954)

In 1928, the Army Air Corps investigated for the first time the feasibility of training aircrew members in the art and science of aerial navigation. The Air Corps decided against it and opted to train pilots in basic aerial navigation techniques. (32:2)

By 1933, aerial navigation training commenced at Langley Field, Virginia and Rockwell Field (now McClellan AFB), California. The training was technique oriented and an on-the-job training approach was taken. From 1933 to 1939 aircrew specialists known as aerial observers trained separately from the pilots. (32:3)

By 1939, the need for aircrew specialists came to the forefront as bomber aircraft entered the flying inventory of weapon systems. At that time 166 aircrew specialists qualified as aerial observers and navigators. The Air Corps planners established the requirement at 506 for 1939 and 1,800 by the end of 1940. (32:3)

The Air Corps decided to contract this training to Pan American Airways which had an established school at Coral Gables, Florida. The contract called for Pan American Airways to train Army Air Corps Observers in the skills of aerial navigation. (29:2) Fifty students

enrolled and flew 50-60 hours in the Sikorsky Flying Boats. (38:86) The course length varied from 12 to 18 weeks and resulted in an aeronautical rating of navigator. (44:1)

In addition to the Pan American Airways school which contracted to produce 850 aerial navigators between August 1940 and December 1941, the Air Corps concurrently initiated aerial navigation training at Barksdale Field, Louisiana and Maxwell Field, Alabama. Barksdale experienced several problems from weather to facilities and ceased training in August 1941. Subsequently, training was commenced at Mather Field, California; Kelly Field, Texas; and Turner Field, Georgia. Production fell short and training facilities were increased and transferred to different fields. Brooks Field, Texas; Hondo Field, Texas; and Selman Field, Monroe, Louisiana, replaced Kelly and Turner Fields by 1942. (32:7-9)

Several prospective pilots complained about the selection process which resulted in many being sent to navigator or bombardier training. One such personal account written in 1943 by an aviation cadet suggested that all the pre-flight school records were tossed into the air and how they landed determined which school you attended. (27:2) The actual selection process reflected the skills required and the aptitude to accomplish uniquely different duties.

Once the Army Air Corps began training navigators and bombardiers, it became apparent that different skills were required for pilots and navigators/bombardiers. Pilots required better "...athletic skill, demanding acute reflexes, sight, hearing, and coordination." Navigators required more "contemplative," intellectual skills and higher aptitudes. The Army Air Forces' aptitude test minimum requirements of 1942-1943 reflected this difference on a scale of 1 to 10 (10 being the highest and 1 the lowest):

<u>DATE</u>	<u>NAVIGATOR</u>	<u>PILOT</u>
Jul 1942	5	1
Dec 1942	5	3
Jul 1943	6	3
Aug 1943	6	4
Nov 1943	7	5 (49:193)

Additionally, the navigator and bombardier training courses proved much more challenging academically resulting in higher attrition and continued shortages. Navigators studied electronics in instruments and avionics, celestial theory and navigation, radar theory and physics, etc. Since the equipment and instruments available were crude and inaccurate much more theoretical understanding was required. (27:5-7)

Radar observers, navigators and bombardiers were often lumped together under the duty title navigator. This caused confusion and misassignment of personnel as these aircrew specialists were trained separately. Once they

were brought together, they trained as combat teams in the B-17, B-24 and later the B-29. Teamwork proved paramount.
(9:16)

In October 1943, training of navigators ceased at Mather Field, California, and operations moved to Ellington Field, Texas. At that time four different aircrew specialists were being trained: celestial navigators (referred to as navigators) bombardier/dead reckoning navigators (referred to as bombardiers but often dual qualified as navigators), celestial navigator/cannoneers, and radar observers (often referred to as aerial observers). Some aircrew specialists were referred to as "Triple Threat" (bombardier-navigator-radar). By 1943 duty title designations had reached a crescendo of confusion. Navigators were not navigators. They were unit certified dead reckoning and/or celestial navigators, or pilots competent in some navigational skills, or graduates of one or more Army Air Forces' schools. (32:36-39) Regardless of the designation, these aircrew specialists stayed focused on accomplishing the mission.

After World War II the Aerial Observer Bombardment Training School combined all navigator, bombardier and radar observer training in 1947. This required retraining World War II navigators and bombardiers. This training varied from 24 to 52 weeks depending on student background. This attempt at commonality continued to 1949. (44:2)

After 1949, Undergraduate Navigator Training began to specialize training using as many as seven different syllabi. Courses varied in length from 90 days to 48 weeks and flying hours ranged from 74 to 188 in the B-25, C-47, C-54 and T-29 (the original "flying classroom"). Additionally, during September 1951 the concept of specialized training for specific aircraft began. Navigator Bombardiers were trained for the B-26. Radar Bombardiers were trained for the B-29. Navigators were trained specifically for the B-50. This specialized training occurred after a basic fundamental course had been completed. The results saw aircrew specialists with the same duty title trained for different specific duties on different specific aircraft. This concept of training continued in many forms under 53 versions of different syllabi until April 1954. (44:2-8)

Spot Summary

The 14 years between 1940 and 1954 witnessed the birth and early development of a new career field, the Air Force Navigator. The navigator, born out of necessity in the midst of World War II, took many forms. No one could decide what a navigator's duties were or what to call the navigator. Navigators were different aircrew specialists with different training and experiences. Not until peacetime after the Korean War did the Air Force make a

concerted effort to draw the boundaries around this career field and create some commonality among all navigators.

Undergraduate Navigator Training (UNT)

1954 - 1986

In 1954 UNT began training all Air Force nonrated officers and cadets under a single syllabus. The previous specialization had created havoc in the navigator career field. Several navigators were released from active duty when their aircraft weapon systems were deactivated. Others were retrained to reach the same standards as UNT graduates.

By January 1959, the Air Force began training "universally assignable navigators." This meant a navigator so trained could serve on any aircraft requiring a navigator after aircraft upgrade training. By 3 March 1965, the last aviation cadet had graduated from UNT and only nonrated officers were accepted for training.

In 1974, the T-29 which had served as the original "flying classroom" was replaced by the T-43, a military version of the Boeing 737. The following year witnessed the addition of a state-of-the-art navigation simulator and the T-37 subsonic jet trainer. All graduates were designated navigators, received the same training and the same wings. Major air commands (e.g. Military Airlift Command-MAC) accomplished aircraft specific training. Air Training Command (ATC) conducted some post graduate

training for electronic warfare officers and bombardiers, but all graduates were universally assignable navigators.
(44:11)

By 1978, the final four or five weeks of UNT were dedicated to specialized training depending on the aircraft assignment. This served as a transition step. For example, navigators selected for fighters received additional flight training in the T-37. This deviation was considered minor and all graduates were still considered universally assignable navigators through 1986.

Spot Summary

UNT provided stability to the navigator career field. A navigator was at the minimum a navigator in that all navigators completed a common-core experience of like training. He could serve as a specialist in an aircraft weapon system (e.g. as a WSO in an F-4), but he had been trained as a navigator first. This common basis was universal among all navigators.

However, as weapon systems continued to become more sophisticated fewer and fewer navigators cross trained from one general classification of aircraft to another. That is few fighter navigators cross trained into transport aircraft and vice versa. This fact among others prompted a revolutionary change in the training of navigators.

Specialized Undergraduate Navigator Training
(SUNT)

In July 1986, Air Training Command implemented a hybrid training course, SUNT (pronounced SUN-TEE). This course combined the advantages of specialized training of the 1950s and universal training of UNT. All students completed a general navigation course of 65 training days and 32 flying hours. In this course dead reckoning navigation received emphasis along with radar, navigation computers, radio aids and inertial navigation systems as aids to dead reckoning. Then tanker, transport and bomber (TTB) bound students broke out and completed 95 additional days and 88 flying hours of training in the T-43 aircraft. This training focused on the aircrew specialty knowledge needed to serve in TTB-type aircraft (e.g. B-1, B-52, C-130, KC-135). The fighter, attack and reconnaissance (FAR) bound students completed an additional 95 training days, 30 flying hours in the T-43 and 14 flying hours in the T-37. This training focused on the aircrew specialty knowledge needed to serve in FAR-type aircraft (F-4, F-111, F-15E). The electronic warfare (EW) bound student completed an additional 101 days of training and 28 flying hours in the T-43. If fighter bound (F-4G or EF-111), the EW student completed an additional 14 flying hours in the T-37 to further prepare him for low level flying. (44:13)

SUNT provides many advantages and satisfies many requirements heretofore neglected. In developing SUNT Air Training Command recognized that less than one percent of students trained in the TTE, FAR or EW track would in their careers cross train from one track-type aircraft to another. For example, a B-52 radar navigator (TTB) would not cross train to a F-15E (FAR) due to training costs and manpower requirements. With cross training at a minimum, the universally assignable navigator had become a luxury. Additionally, SUNT provides each track student more relevant training and more relevant flying time. A student bound for fighters does not study celestial navigation, an aid to navigation he will never use. Therefore, more training is accomplished and a better prepared aircrew specialist is provided the major air commands at no additional cost.

All graduates of SUNT, however, are designated navigators while only the TTB students actually study traditional, classic aerial navigation. Although this constitutes approximately 50 percent, TTB is preparing to train fewer students in traditional aerial navigation. Additionally, as all SUNT graduates progress to specific aircraft upgrade training, 75 percent will assume new duty titles which will be examined in Chapter IV. Regardless the specific duty title, SUNT graduates are no longer

universally assignable navigators, and most will never be regarded as navigators.

Spot Summary

SUNT has revolutionized the training of aircrew specialists. The duty title navigator misidentifies the graduates of SUNT. The common bond of the universally assignable navigator is gone.

What are these graduates then? Chapter IV will explore AFR 36-1 and analyze present duty requirements in 15 aircraft weapon systems.

CHAPTER IV

PRESENT DUTIES AND TITLES

The Navigator-Observer Utilization Field encompasses the organizational functions that implement Air Force doctrine through the employment of manned aerospace systems in peace and war. (These functions include the command and management of aerial navigation, bombardment, airdrop, radar interception, airborne electronic warfare, and aircraft performance.)

AFR 36-23 (dtd 16 April 1973)

...These specialties include navigators, radar navigators, electronic warfare officers, weapon systems operators....

AFR 36-23 (dtd 1 January 1989)

In this chapter the author will analyze present duty requirements in 15 weapon systems and 8 Air Force Specialty Codes (AFSCs). First, a summary analysis of AFR 36-1, Officer Classification, will be presented for each AFSC. Second, expert testimony by former fully-qualified, experienced aircrew specialists will be presented. The author used a standard interview format for all experts (see Appendix for the format). From these two sources, present duties and titles will be analyzed in an effort to address the stated problem. Additionally, a suggested new duty title, Aerospace Flight Officer (AFO), was presented as a potential new duty title to replace "Navigator." Initial responses were recorded as well as other potential duty titles.

Officer Air Force Specialty

Navigator, Weapon Systems Officer, Strategic Reconnaissance

AFSC 1505

Officers serving in this Air Force Specialty Code (AFSC) are assigned to Strategic Air Command and are called Reconnaissance Systems Officers (RSOs) in accordance with (IAW) with SACR 51-71. (40: 1-3) They fly the SR-71, "Blackbird." Although this aircraft first flew over 28 years ago, the SR-71 still holds the world speed record having flown 2,193.167 mph in July, 1976. Its primary mission is strategic reconnaissance. The SR-71 can provide reconnaissance coverage of 100,000 square miles per hour. (51:180) The RSOs' duties and responsibilities IAW AFR 36-1 include flight planning of reconnaissance missions. Specifically, this translates into deciding and planning the route, analyzing the target area, the weather in route and over the target, and potentially dangerous air defenses. Additionally, the RSO shoulders the responsibility of preflighting and accepting all aircraft "navigational, sensor, and communications systems...including specialty equipment." During the mission the RSO performs several "co-pilot" functions, enroute navigation functions, and systems operation functions. Postflight duties include debrief of the mission and intelligence gathered. (4:A8-37-40)

The above duties and responsibilities of an SR-71 RSO are those listed in AFR 36-1, Officer Classification. In order to expand on the duties and responsibilities of an RSO the author interviewed Lieutenant Colonel Frank W. Stampf, USAF who served as an RSO from 1979--1983 and who authored the article "SR-71 Mach 3+" in the Spring, 1982 Navigator magazine. (46:4-8) In this article he explained "The role of the RSO bears little similarity to the traditional duties of earlier airborne navigators and the navigation usually is taken care of by the black boxes (Astro-Inertial Navigation System)." During the interview Colonel Stampf emphasized crew coordination, situational awareness and monitoring systems as his primary duties. He acknowledged accomplishing all duties as indicated in AFR 36-1, but clarified navigational duties. "Navigational duties in flight consisted of maintaining a running dead-reckoning (DR) position and monitoring systems." This was a vital part of the mission but only a small part of the classic, traditional navigator's duties. When asked what his duty title was he responded, "RSO." When asked if he were a navigator he said, "No, RSO." When asked what he thought of the duty title "Navigator" he said, "Navigator is outdated. It has the perception of being outdated." When asked if he would support a new duty title he said, "Yes." When asked what he thought of Aerospace Flight Officer (AFO) he responded, "AFO would be good." (45)

Spot Summary

The SR-71 aircrew specialist is not a traditional navigator. He is an RSO. Although DR is a vital duty of the RSO, he does not employ other classic navigational skills. To the RSO interviewed the title Navigator is obsolete and should be replaced.

Officer Air Force Specialty

Navigator, Bombardier, Strategic

AFSC 1525

Officers serving in this Air Force Specialty Code (AFSC) are assigned to the Strategic Air Command and fly the B-52 as navigators or radar navigators (RNs). The FB 111 as radar navigators (RNs) under SACR 51-111 (41:5-1) or the B-1 as offensive systems officers (OSOs) under SACR 51-1 (39:1-2). These are the bombers of today's Air Force. The B-52, Stratofortress, still provides a significant contribution to the "Triad." The "G" and "H" versions which first entered service in the late 50s and early 60s have been modified to perform both conventional and strategic nuclear missions. Among these missions are the delivery of nuclear air-launched-cruise-missiles (ALCM) and "naval antisurface warfare" using the Harpoon missile. The FB-111 is a "high-precision, low-altitude weapons delivery in all weather, day or night" strategic bomber aircraft. It entered service in 1969 and is projected to serve through the 1990s. The B-1 provides a deep nuclear

penetration threat. It flies low and fast increasing its survivability. On 4 July 1988, a B-1B broke the world record for speed with payload flying 2,000 km at 1,078.2 km/hr (669.16 mph) with a payload of 30,000 kg (66,140 lbs). In addition to speed the B-1 has incorporated state-of-the-art electronic counter measures (ECM) and radar-absorption materials. The B-1 placed in service in September 1986 will serve the US into the next century.

(51:175-76) The duties and responsibilities of these bomber aircrew specialists under AFR 36-1 include planning "navigation, bombing, rendezvous, and airborne missile launch phases of missions," preflighting "nuclear and conventional weapons, bomb-bays, communication systems release mechanisms, airborne missile systems, and navigation and rendezvous equipment," and operating "navigation, bombing, rendezvous, and airborne missile systems to accomplish mission." (4:A8-41-42)

The above duties and responsibilities of a B-52 Navigator or RN, a FB-111 RN and B-1 OSO are those listed in AFR 36-1, Officer Classification. In order to expand on the duties and responsibilities of each the author interviewed Lieutenant Colonel Paul Frichtl, USAF (16) who served in the FB-111 from 1976 to 1985 and in the B-1 from 1985 to 1988, and whose last position prior to attending Air War College was Chief, B-1B Offensive Systems Officer, Dyess AFB, TX. The author also interviewed Lieutenant

Colonel Richard Evans (14) who served in the FB-111 from 1974 to 1984 before assuming his position as Commander, 380th OMS, Plattsburgh AFB, NY prior to attending Air War College. Finally, the author interviewed Lieutenant Colonel Craig Ray (37) who served in the B-52G from 1970 to 1974 in combat in Vietnam as a navigator and radar navigator.

During the interview with Col Ray, a former B-52 aircrew specialist, it became clear that the B-52G model bomber required a traditional, classic navigator in the early 1970s. Col Ray listed all the traditional duties (e.g., DR navigation, day and night celestial navigation, pressure pattern navigation, grid navigation and radar navigation) of the navigator as necessary. However, he expanded on the duties of the radar navigator (RN) as they approached the target area. The RN became a bombardier using sophisticated weapon systems. "I (as an RN) helped the navigator enroute only, once on the target I was focused on the weapons and the target." Col Ray stated he would support a duty title change "if it would help." When asked for his reaction to Aerospace Flight Officer (AFO) as a replacement for navigator, he simply stated, "I'd support AFO for the future."

The author next interviewed Col Richard Evans, a former FB-111 Radar Navigator (RN). During this interview it became clear the FB-111 aircrew specialist has many

varied duties very few which can be described as navigation. Col Evans stated, "I was primarily a co-pilot, bombardier and electronic warfare officer...navigation was mostly automated. The RN is more of a weapon systems officer (WSO) than a navigator... After TAC (Tactical Air Command) takes over the FB-111, they will probably change the duty title to WSO." When asked what he thought of the duty title navigator he responded, "Navigator is going backwards... We are not navigators." When asked about aerospace flight officer (AFO) as a possible replacement for navigator, Col Evans stated, "The time has come for something like AFO... I like AFO; it sounds more like what we do, more descriptive."

Finally, the author interviewed Col Paul Frichtl, a former B-1B Offensive Systems Officer (OSO) and FB-111 RN. Col Frichtl supported what Col Evans had said about the FB-111. He stated, "The RN is more intensely involved in co-pilot duties and electronic counter measures. These included fuel monitoring and emergency procedures. I used radar and low level techniques and monitored the inertial navigation system (INS), but this was only part of what I did." When asked if navigator described his duty well he said, "Navigator is a detriment...change it to something else." When asked his opinion of aerospace flight officer (AFO) he responded, "Yes...AFO would be good."

When the interview turned to the B-1B it became very apparent the offensive systems officer (OSO) is not a traditional point-to-point navigator. Col Frichtl indicated much of the mission planning is computerized. He also indicated, "The B-1B OSO has no real-time manual capability to navigate." Col Frichtl sketched a schematic of the B-1B's four computers indicating one was the navigation computer. The fourth computer serves as a "hot spare" for the remaining three. As Col Frichtl said, "Lose any two you cancel and go home." The OSO does not navigate; he monitors the navigation computer. When the author asked Col Frichtl what he thought of the title "navigator", he explained, "Navigator is obsolete; it hurts all of us (aircrew specialists with AFSCs 15XX)." When asked about AFO, he stated, "AFO would be good... It would be good for all aircrew members, pilots and navigators."

Spot Summary

After analyzing AFR 36-1 and interviewing three aircrew specialists who have 29 years experience as 1525 Navigator-Bombardier, Strategic Officers, a common theme surfaced that the duty title "navigator" does not accurately reflect the duties of the B1 OSO, FB-111 RN or the B-52 RN. Furthermore, aerospace flight officer (AFO) was well received and supported by all three experts. To summarize their support for AFO, it is clear that navigators in the FB-111 and B-1B are not navigators in the

traditional sense. Additionally, with the modifications in the B-52, navigational duties have been replaced by specialty functions. The experts all agree. "Navigator is obsolete...is going backwards."

Officer Air Force Specialty

Navigator, Tanker

AFSC 1535

Officers serving in this Air Force Specialty Code (AFSC) are assigned to the Strategic Air Command and fly the KC-135 as navigators. The KC-135, Stratotanker, remains an essential weapon system in the USAF inventory and with ongoing retrofit of new engines and other modifications will serve until 2020. This tanker aircraft can refuel Air Force, Navy, Marine and many allied nations' aircraft. It has a 120,000 lb. transfer air fuel capacity compared to 200,000 lb for the KC-10. However, there are 58 KC-10s compared to 594 KC-135s in today's Air Force.

(51:184) The duties of the KC-135 Navigator under AFR 36-1 include planning "navigational phases of mission...prepares navigation flight plan," ensuring "navigational equipment is inspected and preflighted" and navigating "aircraft, using dead reckoning aided by map reading, celestial observations, and electronic devices." (4:A8-43-4)

The above duties and responsibilities of a KC-135 Navigator are those listed in AFR 36-1, Officer Classification. In order to expand on the duties and

responsibilities the author interviewed Lieutenant Colonel Leo M. Cutcliff, USAF (13) who served in the KC-135 from 1973 to 1983 as a navigator. During the interview with Col Cutcliff it became clear that as an aircrew specialist on the KC-135 he was a navigator. "I was a navigator...that really was my job," stated Col Cutcliff. However, when asked about the possibility of replacing "Navigator" as a duty title he said, "I would support a new duty title because inflight duties are changing with new avionics." In fact the KC-10, does not carry a navigator as computers accomplish the traditional navigational duties. However, the Strategic Air Command stands on record to keep navigators on the KC-135 to ensure flexibility and coverage in more difficult environments. When asked what he thought of aerospace flight officer (AFO) he replied, "AFO would be great...it's not too confining but I wouldn't support it for non-rated aircrew members."

Spot Summary

The KC-135 stands as one of the last bastions of the traditional navigator. Even in this Air Force specialty a look to the future exposes the benefit of replacing "Navigator" with "AFO."

Officer Air Force Specialty
Navigator, Airlift/Transport
AFSC 1545

Officers serving in this Air Force Specialty Code (AFSC) are assigned to the Military Airlift Command and fly the C-130 and C-141 as navigators. These aircraft are referred to as transports. The C-130 Hercules, began service in 1955 and is still being produced with modifications. This aircraft provides considerable versatility as an intra-theater or tactical transport. It can carry a maximum payload of 50,000 lbs. 2,356 miles. The C-141, Starlifter, began service in 1965 but was significantly modified beginning in 1979 by lengthening it 23 ft. 4 in. The C-141 provides inter-theater or strategic transport. It can carry a maximum payload of 89,000 lbs. 2,293 miles; however, with its air-refueling capability its maximum distance is limited only by aircrew criteria, aircraft airworthiness, availability of tankers and weather. (51:184) The duties and responsibilities of these aircrew specialists include planning "navigational phases of mission" to include unique preparations for airdrop mission (computed air release point computations), preflighting equipment and navigating "aircraft, using dead reckoning aided by map reading, celestial observations, and electronic devices." (4:A8-45)

The above duties and responsibilities of C-130 and C-141 Navigators are those listed in AFR-36-1. Officer Classification. In order to expand on these duties and responsibilities the author interviewed Lieutenant Colonels Kenneth R. Pribyla (36) and Larry D. Magnuson (30) who navigated the C-130E for a combined total of 16 years.

From the interviews it is clear that the C-130 Navigator is the purest example of the traditional, table navigator. Even this purity has been clouded by the additional aids to navigation and the special air drop missions of the aircraft. In fact the primary requirement for navigators on the C-141 aircraft is for airdrop missions. On most all other missions the C-141 does not carry a navigator. Both aircrew specialists interviewed agreed that "Navigator" was appropriate for now but future avionics and missions may make "Navigator" obsolete. Both preferred aerospace flight officer (AFO) for the future.

Spot Summary

This aircrew specialty appropriately supports the duty title "Navigator." The primary duty of the C-130 Navigator is point-to-point navigation. But even here the evolution in avionics and special missions supports the possibility for change. AFO received solid support as the duty title of the future.

Officer Air Force Specialty

Navigator, Weapon Systems Officer, Fighter

AFSC 1555

Officers serving in this Air Force Specialty Code (AFSC) are assigned to the Tactical Air Forces (Tactical Air Command, Pacific Air Forces and United States Air Forces in Europe) and fly the F-4, F-111 and RF-4 and carry the duty title of weapons systems officer (WSO) under TACM 51-50. (47:1-1) These aircraft are referred to as fighters (F-4 and F-111) and tactical reconnaissance (RF-4) aircraft. The F-4, Phantom II, was designed in the mid-1950s and is still undergoing modifications for extended service primarily in the Air Force Reserves. The F-4 proved its versatility in Vietnam by performing counter air, close-air-support, and interdiction missions. The F-111 provides the USAF its "only long-range, around-the-clock, interdiction fighters." Several versions of the F-111 have been produced since it became operational in October 1967, and with continued modification the F-111 will fly well into the 1990s. The RF-4 is an unarmed tactical reconnaissance aircraft. It became operational in May 1964 with the last RF-4 being produced in December 1973. Its primary reconnaissance systems are optical cameras and infrared sensors. It also served with distinction in Vietnam. (51:176-178) The duties and

responsibilities of these aircrew specialists include planning, "navigation, bombing, intercept, reconnaissance, and radar phases of mission," ensuring "weapon systems.... ordnance, sensors, and special equipment" are preflighted, operating "aircraft equipment," and assisting "the aircraft commander in air and ground operations, reconnaissance, interception, weapon delivery of conventional and nuclear ordnance in both air-to-air and air-to-ground missions."

(4:A8-47-8)

The above duties and responsibilities of F-4, F-111 and RF-4 WSOs are those listed in AFR 36-1. Officer Classification. In order to expand on these duties and responsibilities the author interviewed Lieutenant Colonel Richard Evans (14) who served in the RF-4 from 1970 to 1974 as a weapon systems officer (WSO) with combat experience. The author also interviewed Lieutenant Colonel Craig Ray (37) who served in the F-111 from 1978 to 1986 and whose last job in the F-111 was Chief, Readiness Division, RAF Upper Heyford, UK. Finally, the author interviewed Lieutenant Colonel Frank Stampf (45) who flew combat in the RF-4 in addition to later flying the SR-71.

During the interviews with Colonels Evans and Stampf, it became quite clear that the primary duty of the WSO was situational awareness aided by DR and radar. The INS was considered accurate if it were within 4-6 nautical miles. Crew coordination was also considered important as

were several traditionally co-pilot duties. Ever since "Combat Team" the WSO has proved equal to the task of flying the backseat of the F-4. When asked whether these two aircrew specialists considered themselves "Navigators," they both firmly claimed WSO as their duty title. Col Stampf stated, "Navigator is misleading." When the author asked for feedback on aerospace flight officer (AFO) as a replacement for navigator, they both gave it strong support. Col Evans said, "The time has come for something like AFO. I like AFO." Col Stampf said, "Navigator is misleading and out of date. AFO would be better."

The author then interviewed Col Ray who as an F-111 WSO also placed situational awareness at the top of his duties. He went on to say the F-111 WSO accomplishes several co-pilot type duties. When the author asked how he identified himself he emphatically stated, "I'm a WSO. I am not a navigator." When asked what he thought of aerospace flight officer (AFO) as a substitute for "Navigator," he said, "There's some tradition behind navigator, but I'd support AFO for the future."

Spot Summary

The 1555 Navigator WSOs take exception when you refer to them as navigators as per the above interviews. All of them believe navigation is only a small part of what they did as aircrew specialists in the 1555 AFSC. With 18 years of experience between them they all agree the duty

title "Navigator" is inaccurate; they also agree AFO would be solidly supported as a replacement duty title.

Officer Air Force Specialty

Navigator, Electronic Warfare/Airborne Command

and

Control/Special Reconnaissance

AFSC 1565

Officers serving in this Air Force Specialty Code (AFSC) are assigned to the Strategic Air Command, Military Airlift Command, Tactical Air Command, Pacific Air Forces, and United States Air Forces In Europe. They fly the E-3, E-4, EC-130, EC-135, HC-130, RC-135, WC-130 and WC-135. These are the mission-unique aircraft of the Air Force. The E-3, Sentry (AWACS), is the sophisticated surveillance and command, control and communications (C³) airborne platform. Initially placed in service in March 1977, it has undergone and continues to undergo enhancing modifications. The E-4 is a military modified Boeing 747 which supports the National Emergency Airborne Command Posts (NEACP) mission. The EC-130 has three special mission variants: ABCCC (battlefield command, control and communication), Volant Solo II (electronic surveillance), and Compass Call (enemy communications jammer). The EC-135 supports strategic C³. At least one EC-135 is airborne at all times with a general officer on board. The RC-135 provides electronic reconnaissance for SAC. The HC-130

supports MAC's specialized search and rescue mission and satellite retrieval. The WC-130 performs weather reconnaissance missions penetrating tropical storms to predict movement and intensity. Finally, the WC-135 provides MAC with long-range weather reconnaissance capability. (51:180-4) The duties of the aircrew specialists who fly these aircraft are many and varied. They include planning "...navigation, rendezvous, orbit, and reconnaissance phases of mission," preflighting all equipment and sensors and operating numerous "navigation, sensor, communications, and defense systems." (4:A8-48.1-48.2)

The above duties and responsibilities are those listed in AFR 36-1, Officer Classification, for the above listed aircraft. In order to specifically expand on these duties and responsibilities the author interviewed Lieutenant Colonel Larry Magnuson (30) who served 17 years in the WC/HC/C-130, and whose most recent assignment was Commander, 1550th Technical Training Squadron, Kirtland AFB, NM. Additionally, they author interviewed Lieutenant Colonel Benjamin Pittman (35) who served as Chief Navigator, 54WRS, Anderson AFB, Guam. Finally, Lieutenant Colonel Leo Cutcliff (13) who was previously interviewed on his KC-135 experience was interviewed as an RC-135 aircrew specialist with 15 years experience. His last position

being Commander, 38th Strategic Reconnaissance Squadron,
Offutt AFB, NE.

In the interview with Col Magnuson he explained how in the WC-130 he would navigate to the general area of a hurricane or typhoon and then become a systems specialist. Col Pittman supported Col Magnuson's explanation and further emphasized that as the mission coordinator crew coordination and timing were also significant duties. When asked how they identified themselves, they both said, "Navigator." However, Col Pittman elaborated, "Navigator is very misleading...I did a lot more than directing the aircraft from point A to point B." Col Magnuson said he considered himself a "systems specialist." When the author asked for feedback on the possibility of replacing "Navigator" with aerospace flight officer (AFO) they both gave wholehearted support. Col Pittman said, "AFO is good, but I'd prefer aviator to aerospace." Col Magnuson said, "AFO sounds good."

Col M jnuson was also interviewed about his duties on the HC-130. On this aircraft his duties were more "traditional" as a navigator. He used celestial, pressure, and grid navigation as aids to DR. He also emphasized crew coordination. He considered himself a navigator on the HC-130; however, he supported AFO for the HC-130 aircrew specialist duty title.

Col Cutcliff explained during the interview how the two navigators on the RC-135 function. He made it crystal clear that precise navigation was required. He said, "We monitor our navigation systems independently and then compare data." Due to sensitivity of the mission and the systems, specific detail was not provided nor sought. Col Cutcliff considered himself a specialist among navigators. When asked if he would support the replacement of navigator with aerospace flight officer (AFO) he said, "I would support AFO as a new duty title because inflight duties are changing with new avionics. AFO would be great. It's not too confining. I would not support AFO for non-rated aircrew members."

Spot Summary

Here again in the WC-130, HC-130 and RC-135 a navigator is not a navigator. All three aircraft require different expertise. Navigation is becoming a smaller part of that expertise. All three support AFO as a replacement for navigator.

Officer Air Force Specialty

Navigator, Electronic Warfare Officer, EWO

AFSC 1575

Officers serving in this Air Force Specialty Code (AFSC) are assigned to the Strategic Air Command, Military Airlift Command, and Tactical Air Command. They fly the F-4G (Wild Weasel), B-52, EC-130, MC-130, AC-130, RC-135, B-1

and EF-111. The EWO performs specialized duties on these aircraft. Only the F-4G and EF-111 will be expanded on in this section. The remaining aircraft are covered elsewhere. The F-4G, Wild Weasel, is a hunter-killer aircraft. Its mission is to find enemy radars then destroy or suppress them. The EF-111, Raven, mission is "barrier surveillance jamming, degradation of acquisition radars during close air support operations, and escort jamming for deep strike missions." (51:176 and 180) The EWOs "operate electronic combat (EC) equipment to locate, analyze, identify and target enemy electromagnetic equipment for avoidance, disruption, jamming, deception and destruction." The duties of the EWO vary from passive electronic countermeasures to active suppression and destruction of enemy forces. The EWO who accounts for about 27 percent of all Specialized Undergraduate Navigator Training graduates is a unique aircrew specialist. No traditional navigational duties are listed for this AFSC. (4:A8-48.3)

The above duties and responsibilities only summarize the wide spectrum listed in AFR 36-1, Officer Classification. In order to expand on these duties in a general manner the author interviewed Lieutenant Colonel Rudolph Kobarg, Commander, 453rd Flying Training Squadron (28) whose squadron trains all USAF Electronic Warfare Officers (EWOs).

In the interview with Col Kobarg, he explained how EWOs are systems operators and how they rely on computers to accomplish their duties. Col Kobarg said, "You can't get enough computer assistance in this business." He went on to say that there is a minimal application of traditional navigation skills except in the fighter-type aircraft (e.g., EF-111 and F-4G). He emphasized an EWO is an integral aircrew member. When asked about the relevance, accuracy and flexibility of the duty title navigator Col Kobarg said, "We need a new duty title as all aircrew members' duties begin to mesh together. The B-2 aircraft commander is supposed to be a pilot, navigator, bombardier and EWO. What do you call him?" Finally, Col Kobarg gave solid support to the effort of replacing the umbrella duty title "Navigator."

Spot Summary

This aircrew specialty has grown exponentially. Many of the EWO's duties are highly classified; therefore, no details of specifics can be offered. In general, the EWO performs aircrew specialist duties which are unique to this AFSC and only minimally related to classical navigator duties. The EWO is not a navigator and as presently trained could not be a navigator without extensive training.

Officer Air Force Specialty
Navigator, Special Operations

AFSC 1585

Officers serving in this Air Force Specialty Code (AFSC) are assigned to the Military Airlift Command and fly the MC-130 and AC-130. These are special mission aircraft of the Air Force. The MC-130, Combat Talon, performs its special operations mission of deep penetration at low-level at night using terrain-following radar and other sophisticated systems. The AC-130, Spectre, supplies precise airborne firepower. The early versions proved valuable in Vietnam, and the latest version won the day on Grenada. This weapon system couples intense firepower (i.e., one 105-mm howitzer, one 40-mm cannon and two 20-mm cannons) with state-of-the-art fire control systems (i.e., forward-looking infrared and low-light-level TV). Further modifications are ongoing which will enhance its all-weather capabilities. The AC-130 is an awesome low-intensity-conflict, special operations weapon system.

(51:179,184) The special operations aircrew specialist who flies these aircraft "plans navigation and strike phases of mission," preflights sensors, weapons and navigational equipment and "...locates and identifies targets and coordinates strike portion of mission." The aircrew specialists in this AFSC perform either as navigators or fire control officers (FCOs). (4:A8-48.5)

The above duties and responsibilities are those listed in AFR 36-1, Officer Classification for the above listed aircraft. In order to expand on these duties and responsibilities the author interviewed Lieutenant Colonel Kenneth Pribyla (36) who flew the MC-130 and served as the Assistant Deputy Commander for Operations, 39th Special Operations Wing, Eglin AFB, FL. The author also interviewed Lieutenant Colonel Ben Pittman (35) who flew the AC-130 from 1970 to 1978 and served in the 1st Special Operations Wing, MacDill AFB, FL.

During the interview with Col Pribyla, he indicated most of his duties consisted of monitoring systems as a navigator on the MC-130. Col Pribyla said, "I monitored and updated systems due to cross check of data. I was called a navigator, but navigator is just wrong, it doesn't fit." When asked whether he would favor aerospace flight officer (AFO) as a replacement for "Navigator" Col Pribyla replied, "I would support AFO 100%."

The author next interviewed Col Ben Pittman, who also flew the WC-130, about his duties aboard the AC-130. When asked to identify his most significant duties Col Pittman explained, "I commanded the mission; the weapons belonged to me. I performed no navigational functions. As mission commander, I used infra-red and television to direct fire. My duty title was fire control officer (FCO). I was never referred to as a navigator except by people who

were uninformed about our mission." When asked if he would support AFO as a replacement for navigator he said, "I totally agree with AFO. Navigator is misleading. I would prefer aviation flight officer to aerospace flight officer, but that's a personal thing. AFO is great!" The term aerospace was selected to be in concert with AFM 1-1 and the Chief of Staff's philosophy of "meeting challenges of tomorrow." (1:iii) Effective December 1959, the term "aerospace forces" replaced the term "air forces" which had previously replaced the original term of "aviation service." (2:1) Aerospace is a forward-looking term which would more accurately identify the aircrew specialists into the next century.

Spot Summary

Aircrew specialists who serve in AFSC 1585 perform sophisticated, specialist duties. Navigator doesn't fit. The duty title navigator is "misleading" and "wrong." The suggested duty title change to AFO was well received and solidly supported. AFO would not be misleading and would provide the flexibility to apply to aircrew specialists on both the AC-130 and MC-130.

CHAPTER V

FUTURE CHALLENGES

With an on-board computer, we can land on the moon automatically. The machine can put us down on a spot within one kilometer of the designated target. But an astronaut navigating by dead reckoning - the way man has steered for centuries - can land dead center. Man must be able to monitor mechanical equipment and determine if it is functioning properly. It is up to the astronaut himself to correct for the unpredicted.

Colonel David Scott, USAF
Apollo 15 Commander (15:17)

The aircrew specialist of the future will fly more sophisticated aircraft and will employ more sophisticated equipment. Numerous advances have occurred in aids to navigation, the "black boxes." Inertial navigation systems (INS), advanced doppler radar, ring laser gyros, and omega represent significant advances in aerial navigation. In looking to the future a few examples may provide insight into what lies ahead: NAVSTAR Global Positioning System (GPS), B-2 (Stealth Bomber) and F-15E.

GPS

NAVSTAR Global Positioning System (GPS) concept exploded on the horizon of advanced avionics in the mid 1970s. GPS would provide space-based data which could be passively received by aircraft to determine a three-dimensional position. Potential applications covered the spectrum of military tactics. This potential still exists, but practical application from an unclassified perspective

has been nil as even the newest aircraft in the Air Force inventory, the B-1, is not equipped to utilize GPS and would require retrofit.

Originally in 1976, the NAVSTAR GPS design required 24 satellites to provide global coverage. This was subsequently reduced to 18 more capable satellites in the early 1980s. However, as of October 1988 only seven functioning GPS satellites have been placed in orbit.

(42:2)

NAVSTAR Global Positioning System (GPS) still offers potential application in several areas. Its three dimensional navigational and positioning capabilities could significantly enhance weapon system implementation. Tests as early as June 1979 proved GPS could consistently provide navigational data within 10 meters of dead center under ideal conditions. Additionally, a fully operational GPS could provide worldwide airborne inertial navigation system (INS) update which would enhance INS equipped weapon systems' capability and flexibility. Another feature of GPS is the "launch and recovery" capabilities. (22:1-4)

NAVSTAR GPS may someday replace all ground-based aids to navigation to include ground nav-aids approach systems such as instrument landing systems (ILS). Basically, GPS could provide all the needed data to launch and recover aircraft from unaided, "bare-base" runways.

(22:9)

NAVSTAR GPS has potential application in a number of combat tactics such as "rendezvous, target acquisition, close air support, interdiction and reconnaissance." The maturation of the NAVSTAR GPS program may someday increase airborne capabilities significantly, but some significant questions and problems presently present formidable hurdles. Cost, vulnerability to electronic counter measures, update and replacement launch capability are a few of the formidable hurdles yet to be conquered.

However, multiple uses for NAVSTAR GPS on ground, on sea and in air are being tested. New antennas are being developed to minimize the effects of combat electronic counter measures (ECM). One antenna design, the controlled radiation pattern antenna, is intended to provide combat aircraft relief from enemy jamming. Several receivers with various antenna designs are being tested with a goal of providing airborne inertial navigation systems a "plug-in" module GPS capability. (7:66)

As of October 1988, seven NAVSTAR GPS satellites are fully operational. These satellites provide limited global coverage. However, in the global areas covered the Air Force has perfected the airborne precision positioning accuracy to a 2-15 meter range. This precision has been accomplished in the three dimensional environment of flight. Additionally, time accuracy has been perfected down to an error rate of 312 nanoseconds. (33:83)

GPS offers new capabilities in civilian aviation such as the Traffic Alert and Collision Avoidance System. Automatic landing systems, wind shear detection systems, surveying and exploration/oil drilling location identification systems potentially add to the value of GPS and drive the overall costs down. The lower the cost the more reasonable the application in military and civilian uses. (33:83)

Spot Summary

NAVSTAR GPS offers a futuristic, sophisticated, hybrid global navigation system. Since 1976 GPS has been just around the corner. Numerous obstacles have prevented full implementation. Limited launch capability of the U.S. and the shuttle disaster demonstrated a vulnerability of the GPS program. Electronic counter counter measures have not reached operational readiness. Space defense systems are in their infancy. Therefore, what presently exists after 12 years of development is a potential aid to navigation under peacetime circumstances. Until and unless NAVSTAR GPS can conquer these and other obstacles military reliance on GPS will remain skeptical and minimal.

B-2

The stealth bomber, B-2, rolled out to meet the public in November 1988. It resembled the "flying wing" of the 1940s, but the comparison stops there. The B-2 has incorporated numerous stealth design features such as "a

rounded, raised cockpit and two twin-engine inlets blended into the flying wing platform." Also incorporated into the aircraft are state-of-the-art composites, radar absorbing compounds which cover the aircraft with additional "stealthy" protection. The B-2 is about as long as the F-15 with a wingspan about that of a B-52. The B-2 design and on-board avionics have resulted in a crew composition of two. (11: 16)

Presently both B-2 aircrew specialists are projected to be pilots; however, several mission related factors have not been resolved. Presently, the aircrew specialist in the right seat performs offensive and defensive systems officers functions as well as being designated the aircraft commander. The aircrew specialist in the left seat performs pilot functions. A third aircrew specialist's position is design compatible, and mission/personnel requirements are subject to modification as the B-2 enters the flight test phase. Initial operational assignment stands projected for the mid 1990's with a projected full production total of 132 aircraft.

(11:16)

Spot Summary

The B-2 will enhance the manned bomber penetration capability into the next century. It will also continue to emphasize the requirement of an aircrew specialist whose primary duties are monitoring and manipulating

sophisticated on-board avionics, weapons and aircraft systems. Who that individual proves to be will depend on several factors yet to be tested. What training and background experience will be required of the right-seat aircrew specialist also stands subject to further study. There has been considerable speculation that SAC favors a dual qualified aircrew specialist. That is an aircrew specialist who has training as a pilot and a navigator.

(18) This ideal aircrew specialist would surely become SAC's "Six Million Dollar Man." Whatever the outcome, it is clear that offensive and defense systems will have to be mastered by this aircrew specialist. Hopefully, the Air Force will not repeat the errors of the B-18 experience in 1938.

F-15E

The "Eagle" soars. The newest, most sophisticated and many insist the most capable fighter aircraft in the world began "full-scale development tests" at Edwards AFB in March 1987. This fighter has already established an enviable flying record of operational availability and capability. The F-15E Combined Test Force director specifically highlighted the "...low-altitude navigation and targeting for night (LANTIRN) system and overall cockpit integration (pilot and weapon systems officer)...as the real stars of the show." Emphasis on cockpit coordination between the pilot and WSO has exponentially

enhanced the performance of the F-15E. (43:59 60) As per Lieutenant Colonel James Boggan, Chief, F-15E Operations Training Development and Commander, Det. 1, 4444th Operations Squadron, Luke AFB. (10) the WSO on the F-15E has a challenging job. The position is a hybrid between an F-4 type WSO and co-pilot. The F-15E WSO has 4 TV-type screens and 2 pistol grip handles to control as many as 14 functions during flight. The WSO controls the radar weapons and the target pod used for laser designation. He also monitors numerous readouts to include position on the "tactical situational display" which provides a running chart. Col Boggan made it clear that no traditional navigation from point to point is accomplished in the F-15E. Even the flight plan is computer assisted and cartridge loaded into the aircraft systems. The F-15E WSO gives new meaning to aircrew specialist.

Spot Summary

As previously proven by "Combat Team" in the F-4 and the Navy's F-14 "Tomcat" programs a second aircrew specialist can significantly enhance the capabilities of a sophisticated aircraft weapon system. The F-15E will carry the WSO into the next century as an integral fighter aircraft aircrew specialist.

CHAPTER VI
CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Prior to 1920 the U.S. Army referred to all its flyers as "aviation officers." Then in 1926 by public law the first distinction between aviation officers was made: Observer and Pilot. Since then the aircrew specialist first known as observer has traveled a rocky historical road with high and low points. Among the high points were the evolved aircrew essentiality of the World War II Army Air Corps and Army Air Forces Navigator and Bombardier, the combat record of the Vietnam F-4 WSO (two of the three USAF Aces) and the evolution of the B-1B OSO and DSO. Among the low points were the predictions of obsolescence in 1946 when the Army Air Forces (AAF) reduced the number of bombardiers, navigators and observers from 50,000 to 1,900, the predictions of obsolescence in the 1970s when "black box" technology began to mature, and the misconceptions of present-day navigator duties. What can most clearly be concluded about the evolution of the USAF Navigator is that this aircrew specialist (known by over 20 duty titles) does not enjoy a homogeneous tradition or history as a navigator. Throughout the period from 1920 to present it has been commonly recognized that a navigator is not a navigator. This distinction started with the training provided.

The first aircrew specialist unique training commenced in 1939. The AAF recognized different skills were needed for navigator-bombardier aircrew specialists. However, training was disjointed and lacked standardization. Duty titles confused the AAF personnel system, as the duty titles did not reflect standardized training nor universal meaning. In short, one navigator was very different from another navigator by training and duties. Then in 1959 a concerted effort was made to standardize training and graduate a "universally assignable" navigator. This concept, though modified through the years, served as the foundation for Undergraduate Navigator Training until 1986. In that year its replacement, Specialized Undergraduate Navigator Training (SUNT), commenced training and graduating aircrew specialists who had only basic dead reckoning skills in common. Although all navigators began as navigators from 1959 to 1986, they soon became dissimilar aircrew specialists once they upgraded in their line aircraft. SUNT recognized the need to provide relevant training for these dissimilar aircrew specialists and has again assured the Air Force of the future that a navigator is not a navigator. The Air Force of the present, however, requires some immediate attention.

The author analyzed the present duty requirement, in 15 weapon systems and all 8 navigation career field officer Air Force specialties. He also examined relevant

regulations and interviewed representative aircrew specialists with a total of over 133 years of experience. From this it was discovered there are eight duty titles which identify present-day aircrew specialists. The Air Force lumps all these aircrew specialists under the "umbrella" duty title and aeronautical rating of navigator. In fact the duty title/aeronautical rating navigator correctly identifies approximately 30 percent of all aircrew specialists in the active inventory of today's Air Force, and this percentage is shrinking. Furthermore, 100 percent of the aircrew specialists interviewed believed the duty title and aeronautical rating navigator was "inaccurate, misleading, exclusive, inflexible, outdated, obsolete, backwards, just wrong and/or a detriment" to their aircrew specialty and the Air Force. Additionally, 100 percent of the aircrew specialists interviewed supported supplanting navigator with the new "umbrella" duty title and aeronautical rating "Aerospace Flight Officer (AFO)." All felt AFO would provide the USAF and the aircrew specialist "more flexibility, more accuracy, more room to accommodate specialization, and more of a future look." In looking to the future the author presented three examples: GPS, B-2 and F 15E.

GPS (NAVSTAR Global Positioning System) still offers a futuristic, sophisticated, hybrid global navigation system, as it has since 1976. GPS still

requires considerable development and testing before it is operationally ready to perform its mission in peacetime and wartime.

B-2 Stealth Bomber has made its debut and will soon begin flight testing. The decision on crew composition remains unsettled; however, someone will be required to perform OSO and DSO functions of the B-2.

F-15E is making progress toward becoming a front line weapon system. Approximately 380 F-15Es will be produced. The crew ratio and training support will require approximately 1,000 WSOs. The F-15E will carry the WSO into the next century.

Overall the future of the aircrew specialist presently identified as "Navigator" appears very bright. The author concludes, however, that the duty title and aeronautical rating "Navigator" does not enjoy a traditional, homogeneous history; was only supported by standardized training for a period which has passed as SUNT is now training three distinct groups of aircrew specialists; does not generate support from present-day aircrew specialists; does not accurately apply to the future or the present; and is wholeheartedly supported for retirement and replacement by a new duty title and aeronautical rating "Aerospace Flight Officer (AFO)."

In 1970 Colonel John Burgess, Director of Navigation Training, Headquarters Air Training Command stated.

...today's - and even more so, tomorrow's - navigator faces so many varying challenges that his title may soon become passe, for as a man's navigation capability expands through technology, so also does his role and responsibility. (15:17)

The time has come to recognize the expanded roles of the navigator and give this aircrew specialist an appropriate duty title and aeronautical rating, "Aerospace Flight Officer."

Recommendations

1. Due to more accuracy, more room to accommodate specialization, more flexibility, and more of a future look, the author proposes the duty title and aeronautical rating "Aerospace Flight Officer (AFO)" replace "Navigator."

2. This proposal should be presented at the next Course Training Standards (CTS) conference. The CTS conference is chaired by Air Training Command and attended by all flying MAJCOMs plus the Air Force Reserve and the Air National Guard.

3. Recommend all attendees return to their commands to gather feedback, study this proposal, and seek their MAJCOM Commander's support; at the subsequent CTS conference the attendees should decide whether to carry this proposal forward to the Air Staff for approval.

4. Concurrently, commission Air Force Human Resources Laboratory (AFHRL) to study the impact of this duty title and aeronautical rating change.

5. Change Specialized Undergraduate Navigator Training (SUNT) to Specialized Aerospace Flight Officer Training (SAFOT).

6. Remove "Navigator" from AFR 36-1 as the preface to each officer Air Force specialty and replace it with AFO (e.g. AFO Weapon Systems Officer).

APPENDIX

Interview Questions

1. As an (aircraft) aircrew specialist, what were your most significant duties?
2. What other duties did you perform on the (aircraft)?
3. What portion of your duties would you call classic or traditional navigation?
 - a. Dead Reckoning (DR)
 - b. Day Celestial (Sun, Moon and Planets)
 - c. Night Celestial (Stars, Moon and Planets)
 - d. Radar
 - e. LORAN
 - f. Pressure Pattern
 - g. GRID
 - h. Map Reading
4. As an (aircraft) aircrew specialist, how would or do you identify yourself and what was your duty title?
5. What would be your reaction to a new duty title to replace "Navigator"?
6. Would you support "Aerospace Flight Officer (AFO)" as a new duty title?

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GLOSSARY

AAC	Army Air Corps
AFB	Air Force Base
AFHRL	Air Force Human Resources Laboratory
AFM	Air Force Manual
AFO	Aerospace Flight Officer
AFR	Air Force Regulation
AFROTC	Air Force Reserve Officer Training Corps
AFSC	Air Force Specialty Code
ALCM	Air Launched Cruise Missile
C3	Command, Control and Communication
DSO	Defensive Systems Officer
ECM	Electronic Counter Measures
EW	Electronic Warfare
EWO	Electronic Warfare Officer
EWT	Electronic Warfare Training
FAR	Fighter, Attack, Reconnaissance
FCO	Fire Control Officer
FSO	Flight Systems Officer
GIP	Guy In Back
GPS	Global Positioning System
HQ ATC	Headquarters Air Training Command
IANC	International Air Navigation Convention
IAW	In Accordance With
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System

INS Inertial Navigation System
LANTIRN Low Altitude Navigation and Targeting for Night
MAC Military Airlift Command
NEACP National Emergency Airborne Command Post
OMS Organizational Maintenance Squadron
OSO Offensive Systems Officer
RN Radar Navigator
RSO Reconnaissance Systems Officer
SAC Strategic Air Command
SACR Strategic Air Command Regulation
SAFOT Specialized Aerospace Flight Officer Training
SUNT Specialized Undergraduate Navigator Training
TAC Tactical Air Command
TACM Tactical Air Command Manual
TTB Tanker, Transport, Bomber
UNT Undergraduate Navigator Training
USAAF United States Army Air Forces
USAF United States Air Force
WSO Weapon Systems Officer